

CLIMATOLOGICAL DATA FOR OCTOBER, 1913.

DISTRICT NO. 1, NORTH ATLANTIC STATES.

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GENERAL SUMMARY.

A decidedly warm October followed a cool September and there was less than 3° difference in the mean temperature for the two months at a number of stations in the New England States. Toward the south, however, the abnormality in temperature was less marked, but the warmth of the first decade, especially from the 8th to the 10th has seldom been equaled in October.

The month was remarkable also for its heavy rainfall and the excessive amount of cloudy weather. It was the wettest October since 1890 in the New England and Pennsylvania sections, and the wettest since 1906 in New York. The freedom from great changes in temperature during the early part of the month was noteworthy and fortunate for the many agricultural sections that experienced practically no freezing weather until the 31st.

The following table exhibits the leading features of meteorological interest for the various sections of the district:

States or parts of States within District No. 1.	Temperature.				Precipitation.				Average number of—	
	Average.	Departure.	Highest.	Lowest.	Average.	Departure.	Greatest total.	Least total.	Rainy days.	Clear days.
New England.....	54.3	+5.1	87	20	6.60	+3.11	11.77	3.05	13	7
New York.....	54.3	+4.2	88	21	5.92	+2.42	11.29	2.78	11	10
Pennsylvania.....	55.6	+3.7	88	24	5.67	+2.19	9.62	3.36	12	9
New Jersey.....	57.8	+3.6	83	25	7.79	+4.08	13.16	2.70	11	12
Maryland, Delaware and District of Columbia.....	58.8	+2.7	92	26	4.49	+1.33	6.45	1.78	11	13
West Virginia.....	53.7	+0.4	83	17	5.61	+3.55	7.75	3.62	10	11
Virginia.....	57.8	+1.7	84	24	4.28	+0.42	5.31	2.95	10	11

TEMPERATURE.

The mean temperature for the month ranged from 49.1° at Indian Lake, N. Y., to 62° at Pocomoke City, Md. It was above the normal at all stations in the district except two in West Virginia. In New England this was the warmest October during the period covered by sectional averages beginning in 1888 and in New York the warmest since 1900. The warmest weather occurred between the 5th and 11th with maximum temperatures close to 80° at most stations and higher in some instances. The highest recorded within the district was 92° at West-ernport, Md., on the 5th. During the period of warmest weather there were several nights with minimum temperatures generally above 60°. On the 9th the mean temperature at Albany, N. Y., was 74°, or 20° above the normal.

The first period of notable cold centered on the 22d and gave two or three days with temperatures below normal, but caused frost only in the colder parts of the Northern States. Over the coast region from Massachusetts southward and in the interior northward to Pennsylvania the first freeze came as a rule either on the 22d or 31st of October, after crops and fruit had been mostly harvested, so that about half of the district experienced practically no loss from frosts.

The minimum temperatures for the month were much higher than usual in October, being but little below the

freezing point in any of the better agricultural sections. At a number of stations in New Jersey, Delaware, Maryland, and Virginia the freezing point was not reached. The lowest temperature recorded within the district was 17° at Bayard, W. Va., on the 22d. The records give no other instance of a temperature lower than 20°.

PRECIPITATION.

The rainfall was remarkably heavy. Only a few stations received less than the October average, and the only station that received less than 2 inches of rain during the month was Solomons, Md., where the total amount was 1.78 inches. Over about one-third of the district, including extensive areas in New England, New York, New Jersey, and Pennsylvania, the total rainfall exceeded 6 inches. The greatest amount at any station was 13.16 inches at Bergen Point, N. J. At that station and some others not far away more than half the month's precipitation came in the remarkable storm of the 1st and 2d. Storms of nearly as great intensity were central over the district on the 12th, 20th, and 25th and gave rains exceeding 2 inches in many places.

There was less snow than usual in October, and most of it fell on the 21st or 31st. Only a few stations reported more than a trace of snow, and these were confined to the colder sections of the Northern States and the mountainous regions of West Virginia. The greatest daily fall of snow was 2 inches at Bayard, W. Va., on the 21st.

MISCELLANEOUS.

The principal rivers were at low or moderate stages until the third decade, when they rose considerably as a result of the heavy rains. In the Northern States the increased supply of water in the rivers made possible the resumption of the use of water power, which had been lacking at numerous points for several weeks.

The amount of sunshine was the least that has been shown by the records for any month in the last two years or more. The percentage of the possible amount ranged from 54 at Philadelphia to 24 at Eastport, Me., and averaged only 38 for the entire district.

The average number of clear days was 10, partly cloudy days 9, cloudy days 12, and rainy days 12.

HEAVY RAINSTORMS OF 1913 AT NEW YORK CITY.

By C. D. REED, Local Forecaster.

An unusual series of excessive rains occurred in parts of New York City and vicinity on July 28, September 4-5, October 1, and October 24-25. June, July, and August heretofore have been the months of greatest intensity of rainfall for short periods of time up to two hours, while September, October, and November have been the months of greatest intensity for longer periods up to 24 hours. The storm of September 4-5, however, established for lower Manhattan a new record of 2.82 inches in two hours, and the storm of October 1 raised this newly established two-hour record to 3.34 inches. Moreover, the storm of September 4-5 established a new record for intensity of September storms for all periods of five minutes to two hours, and the

storm of October 1 established a new intensity record for October storms for the same periods.

The area involved in the excessive rain of July 28 was small, but on that date at the New York Meteorological Observatory in Central Park 2.74 inches were recorded in one hour and 3.11 inches in two hours. This precipitation resulted from a local thunderstorm.

The other heavy rains here considered were features of general storms which covered large areas, though the areas of excessive precipitation were not relatively large, and the amounts within the excessive areas varied considerably. At the Central Park Observatory, during the storm of September 4-5, 3.31 inches were recorded in one hour and 3.70 inches in two hours, establishing new records at that station and probably for the city in those periods for the last 45 years.

The storm of October 1-2 extended somewhat beyond the 24-hour period shown in the table below, and the area of excessive precipitation included a considerable part of northeastern New Jersey and adjacent parts of New York, but apparently not extending eastward much beyond the limits of Greater New York. Primarily this rain resulted from a moderate barometric disturbance that moved from western Pennsylvania at 8 a. m. of the 1st to the New Jersey coast at 8 p. m. A thunderstorm during the afternoon of the 1st contributed to the intensity of the rainfall. The first thunder was heard at the Battery at 12.45 p. m. in the east; the last at 4.54 p. m. in the west. Aside from the progressive movement of the lightning flashes and the thunder, the direction of movement was not apparent, for the other features of the thunderstorm were masked by the general storm then prevailing over several States. The wind was continuously from the east and probably carried the thunderstorm along with it, though this direction of movement is unusual at this station. In New Jersey, southward from New York, the rain was about as heavy in the forenoon of the 1st as during the afternoon; in the vicinity of New York it was heaviest in the afternoon; while eastward over Long Island heavy rain continued during the 2d. The locality of heaviest precipitation was Staten Island. The total amounts for the storm, beginning the early morning of the 1st and ending the early morning of the 2d, believed to be from reliable catch and measurement, are as follows:

Local office, United States Weather Bureau, 17 Battery Place...	5.19
Brooklyn Eagle.....	4.59
Central Park, Arsenal Building.....	5.11
Bronx, Borough Hall.....	3.70
Bronx, 1517 Williamsbridge Road.....	2.50
Staten Island, St. George, Borough Hall.....	8.47
Jersey City, N. J., 315 York Street.....	6.13
Bayonne, N. J.....	7.00
Newark, N. J.....	6.40
South Orange, N. J.....	4.16
Elizabeth, N. J.....	4.88
Long Branch, N. J.....	4.37
Paterson, N. J.....	3.15

At Sandy Hook, N. J., the amount recorded from noon of the 1st to 6.08 a. m. of the 2d was 1.55 inches, while at St. George, Staten Island, about 12 miles distant, the amount for the same period was 7.88 inches. Before that period the gage at Sandy Hook was out of order. Assuming that the amount before noon was similar to that at Long Branch, the total for the storm at Sandy Hook would be approximately 3 inches.

Naturally such extraordinary intensity of rainfall overtaxed the sewers and the drainage facilities of the subways, the tunnel systems, and the transportation lines in general; and traffic was much impeded for many hours. After the storm of September 4-5, emergency pumps were provided, but even they were inadequate to cope with the situation in the succeeding storms, though they shortened the period of disorder after the storms ceased. The drainage from the roofs of many large buildings proved inadequate.

The experiences brought about by these storms have raised many new engineering problems. In considering changes of construction for reducing or eliminating the damage resulting from such storms, the initial cost of such changes and the upkeep for periods between storms must not be greater than the damage done by the storms. Hence the frequency of such storms becomes an important consideration. As nearly as can be determined from the records available, storms of equal intensity have not occurred in the preceding 45 years, but since 1869 storms of nearly equal intensity occurred in 1878, 1902, 1905, and 1913. So it is fair to assume that such storms are likely to occur at least once in each 10 years. It should be borne in mind that several such storms may occur in one year, and within three of the last 12 years there have been six such storms. But there is nothing in the facts presented to warrant the assumption that such rains are becoming either more frequent or more intense than formerly.

The following table shows the intensity of the four severe storms of 1913 at three points in Greater New York:

Maximum amounts in short periods of time.

Date and place.	5 min-utes.	10 min-utes.	15 min-utes.	30 min-utes.	1 hour.	2 hours.	24 hours.
July 28, 1913:							
17 Battery Place.....	0.36	0.47	0.49	0.51	0.54	0.57	0.62
Brooklyn Eagle.....	.15	.23	.28	.29	.32	.36	.38
Central Park Observatory.....	.52	.99	1.21	1.49	2.74	3.11	3.11
Sept. 4-5, 1913:							
17 Battery Place.....	.36	.64	.86	1.37	2.00	2.82	3.44
Brooklyn Eagle.....	.40	.74	1.08	1.54	1.92	2.27	3.03
Central Park Observatory.....	.60	1.15	1.59	2.62	3.31	3.70	4.14
Oct. 1-2, 1913:							
17 Battery Place.....	.44	.77	1.05	1.64	2.26	3.34	5.18
Brooklyn Eagle.....	.31	.52	.72	1.23	1.59	2.31	4.59
Central Park Observatory.....	.56	.78	1.01	1.56	2.03	3.35	5.07
Oct. 24-25, 1913:							
17 Battery Place.....	.12	.21	.27	.43	.54	.76	3.03
Brooklyn Eagle.....	.14	.22	.30	.51	.61	1.12	3.76
Central Park Observatory.....	.22	.37	.47	.71	.83	1.17	3.94